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# Tree Cover of Accra's Neighbourhoods—a Green Divide

Lyn-Kristin Hosek<sup>1,2</sup> 

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## Abstract

Intra-city differences in tree cover are one way in which the urban divide physically manifests itself, adding a green component to the discussion of urban inequalities. I determined the canopy cover of Accra and its 76 neighbourhoods using the ‘dot method’ approach where random points are displayed on aerial photographs and categorised as located either on a tree or not, obtaining neighbourhood values between 0.2 and 53.6%. The average crown cover of non-poor neighbourhoods is 23.1%, continuously declining to 3.5% in areas of highest poverty. Examining historical events and processes, it can be seen that this canopy cover distribution originates from colonial tree planting patterns. Analysing these legacy effects not only aids our understanding of the present but also can help increase precision when assessing the possible impacts current laws and policies or management systems might have on our urban forest.

**Keywords** Ghana · Inequality · Intra-city variation · iTree Canopy · Legacy effects · Tree cover

## Introduction

A group of five men reading the Quran, protected from the midday sun by a tree's dense canopy; the trunks of large road-side trees decorated with flags of the competing political parties; a populous colony of bats hanging in the mahoganies. Urban trees, like their rural counterparts, perform a number of ecosystem functions and the resulting goods and services directly or indirectly contribute to human well-being. In city environments, trees create a space for recreation and social interactions (Sullivan et al. 2004; Tyrväinen et al. 2005), produce shade and decrease temperatures (Lin

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and Lin 2010), offer a habitat for wildlife (Stagoll et al. 2012), reduce ground-water run-off, noise, and air pollution (Coder 1996; Dwyer et al. 1992; Nowak et al. 2006; Yang et al. 2005), sequester carbon (Nowak and Crane 2002), and support diets (Borokini 2012). With a growing urban population—projected to increase from 55% in 2018 to 68% by 2050 (UN 2018)—trees and their services can help create living conditions conducive for the city inhabitants' physical and mental health. Maintaining existing trees and incorporating them into future urban planning and development can help mitigate some problems encountered in densely populated cities and is important as inhabitants of heavily built-up areas are especially prone to climate-related risks like flooding, heat stress, and air pollution (Gabriel and Endlicher 2011; Mage et al. 1996; Rain et al. 2011), problems which are anticipated to become even worse (IPCC 2013).

Some ecosystem functions of urban trees, however, challenge the common narrative that trees are generally 'good' and that planting should happen, as the results are disservices rather than goods and benefits. Disservices can be of financial, social, or environmental type (Escobedo et al. 2011) and include labour and capital for planting, pruning, removing, and replacing trees; damage to infrastructure like cables, sidewalks, roads, and houses; allergic reactions; attracting undesirable and potentially disease-bearing wildlife; the fear of crime in densely vegetated areas, or fertilisers and pesticides harming the environment (Escobedo et al. 2011; Gómez-Baggethun and Barton 2013; Lohr et al. 2004; Lyytimäki 2014). A comprehensive cost–benefit analysis of urban trees, however, is difficult and the limitations of existing studies preclude judgement as to the net value of urban trees (Song et al. 2018). As this assessment depends not only on study design—the choice of valuation method, services, and disservices examined, and the considered scale and time—but also, among others, on the environmental, political, economic, social, and demographic context of a specific location, a conclusive analysis might be impossible. I suggest that in Accra, the more important services of urban trees include reduced indoor and outdoor temperatures, removal of traffic-derived pollutants and particulate matter, and reduced storm water run-off as excessive heat, pollution, and flooding have serious health implications including death. Until otherwise shown, I am, therefore, working based on the assumption that the benefits of urban trees in Accra exceed their costs, especially under optimised species–site matching and maintenance schemes.

The structure of an urban forest determines which services are produced where and to which extent (Dobbs et al. 2014). Elements like canopy cover, leaf area, or species diversity, however, show pronounced intra-city spatial variation in places around the world. These differences tend to correlate with socio-economic variables as examples demonstrate that urban tree cover is positively correlated with median household income at census block level in seven US cities (Schwarz et al. 2015), tree biodiversity and total number of trees is higher in wealthier neighbourhoods in a Brazilian city (Pedlowski et al. 2002), and trees are in better health in richer neighbourhoods in South Africa (Kuruner-Chitepo and Shackleton 2011). The residents of affluent neighbourhoods are more likely to profit from tree services than those in less affluent ones who, however, tend to be more susceptible to the negative effects of poor urban living conditions. Low-income neighbourhoods are located in areas more prone to flooding (Amoako and Inkoom 2018), temperatures can get higher (Mehrotra et al. 2018), and air pollution is more severe (Dionisio et al. 2010). Focussing on indicators of urban forest structure at the city level might, intentionally or unintentionally, conceal

spatial inequalities, but this ‘green variation’ needs to be explicitly addressed if tree planting is promoted as a means to mitigate some of the negative effects of rapid, unplanned urban growth and climate change.

For this study, I examined canopy cover, one variable of urban forest structure, providing spatially explicit baseline information and its correlation with socio-demographic variables at neighbourhood level. Simply establishing that Accra is yet another city where tree cover varies between areas is insufficient, however, if we want to avoid further deepening the divide. Instead, we must discuss historical legacy effects, i.e., the events and processes that have produced the current structure (Roman et al. 2018). While intra-city inequalities might also be reflected by the distribution of other types of green spaces, like urban agricultural lands or lawns (Stow et al. 2013), this research focused on trees and their particular services like shading or air pollution removal which are provided at a smaller amount or not at all by other types of vegetation. Additionally, trees have a long lifespan and the slow nature of growth creates an inherent ‘time lag’ that provides a unique window through which the legacy effects can be examined.

## Methods

I determined the tree cover of Accra and its neighbourhoods between February and April 2016 using iTree Canopy (<https://canopy.itreetools.org/>), an online tool provided by the USDA Forest Service. This tool was chosen as it is freely available and requires no extensive training or technical knowledge and can easily be used by anyone involved in urban forest planning and management. On the website, the user uploads shapefiles of the study area and the programme overlays them on Google Maps aerial photographs, displaying random points which can then be classified according to previously defined land cover categories. The iTree Canopy developers suggest categorising between 500 and 1000 points as the standard error decreases for an increasing number of points. For the purpose of this study, I categorised 500 points per neighbourhood as well as for Accra as a whole, using the categories ‘tree’, ‘non-tree plantable’, and ‘non-tree non-plantable’ (Table 1). After categorising the desired amount of points, the tool generates reports summarising the percent values of each land cover category, the area this translates to, and the respective standard errors (reported in brackets in the discussion section). Due to the relatively poor quality of the aerial photographs, a more detailed land cover division was not possible and even the basic distinction between ‘tree’ and ‘non-tree’ was difficult in some places.

**Table 1** Land cover categories with examples

Land cover	Examples
Tree	Tree
Non-tree plantable	Roadsides Private backyards
Non-tree non-plantable	Road centres Buildings Water bodies

Additionally, the quality of the aerial photographs varied within the city potentially increasing misclassification of some points over others.

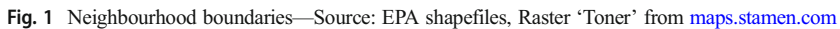
The neighbourhood boundaries used in this project are identical to those in the Accra Poverty Map (CHF International and AMA 2010), allowing to investigate relationships between canopy cover and other characteristics. The poverty mapping exercise rated individual neighbourhoods on eight variables (population density, income level, housing density, room occupancy, nature of access to water, domestic waste water, mode of solid waste disposal, and nature of access to toilet facilities) on a five-point scale (non-poverty, low poverty, moderate poverty, high poverty, very high poverty) using the obtained values to assign an ‘overall poverty class’ to each neighbourhood (Table 2). As three neighbourhoods—Airport (no access), Burma Camp (military zone, no access), and Korle lagoon—were excluded from the mapping exercise, I also did not include them in the tree cover analysis (Fig. 1).

The continuous data obtained from the canopy cover analysis was transformed into categories to resemble the poverty mapping exercise and to facilitate data visualisation. I used Jenks’ natural breaks classification method to obtain five canopy classes from the measured values as there are no pre-defined categories as to what constitutes low or high urban tree cover due to the place-specific nature of this variable. The Jenks method clusters data in a way that the average deviation from the class mean is minimised while each class’s deviation from the means of the other ones is maximised. The Accra average of 14% ended up in the second lowest class because Achimota College, a neighbourhood that includes the 3.6 km<sup>2</sup> Achimota Forest, has a canopy cover of 53.6%, significantly higher than the second highest value of 33.6% in Legon. As the city average should be a reference for intra-city variation, Achimota College was excluded as an outlier resulting in the city average being located in the middle class (Table 3). The neighbourhood map was coloured according to these canopy cover classes with lighter green for lower percentages and darker green for higher values.

Statistical analyses were conducted using the software ‘R’ (R Core Team 2015), employing the Fisher-Freeman Halton test. This test is suitable for  $5 \times 5$  contingency tables if observed numbers include zeros or more than 20% of cells have expected numbers smaller than five as was the case for canopy cover and poverty classes. For computational reasons, the test was used with the Monte Carlo method (1,000,000 replicates). Archival research was done in the National Archives of Ghana in April 2017 to gather historical information about trees in the city. I focussed mainly on Town Council and departmental reports as no document list for urban trees existed. Additionally, as part of a multi-method research design, four households from Nima, Mamobi, and Kokomlemle were chosen for a case study that included interviewing household members.

**Table 2** Number of neighbourhoods in each of the five poverty classes

Poverty class	Number of neighbourhoods
1–Non-poverty	07
2–Low poverty	14
3–Moderate poverty	25
4–High poverty	28
5–Very high poverty	02



## Human-Nature Interactions and their Legacy Effects

Legacy effects are ‘impacts that previous events, processes, and phenomena have on current properties or processes’ (Roman et al. 2018, p. 159) and being aware of these historical influences matters because they help our understanding of current processes and patterns (Szabó 2010). The importance of history in ecology has been recognised

1	0.2 to 6.6	28
2	7.4 to 11.8	17
3	12.4 to 17.4	14
4	19.4 to 24.8	09
5	26.2 to 33.6	07

by several authors (e.g. Bürgi et al. 2017; Cook et al. 2012, Roman et al. 2018) who created different frameworks that demonstrate the interconnectedness of society and environment in and over time. Here, history is broadly defined to include both past human and natural activities which are termed ‘biophysical’ and ‘human’ legacies by Roman et al. (2018) and include e.g. ecological disturbances like extreme weather events and disease outbreaks or aspects related to national and regional identity. These influences act within the bioregional context i.e. climate, native biome, or regional species pool and ‘co-produce spatio-temporal dynamics of urban tree canopy cover, species composition, and diversity’ (Roman et al. 2018, p. 158). While biophysical legacies, such as the minor and major earthquakes Accra experiences (Amponsah 2004) or pest and diseases (ADM 5/1/59 Government of the Gold Coast–Departmental Reports for the year 1904), have likely had an impact, my focus is on human legacies, specifically city planning and development. Legacies are numerous, often interacting with each other in complex ways and the following parts should be read as an example of how some selected processes have shaped Accra’s urban forest rather than as an all-encompassing explanation for its current structure.

### Urban Trees in Accra—the Past

Accra’s beginnings date back to the late sixteenth century when it was established as a fishing port. It remained small in area and population, however, until it became British headquarters in 1877. While determining original vegetation cover can be complicated, there is agreement that the area used to be covered in forest (e.g. Owusu 2018; Stow et al. 2013), dry semi-deciduous forest that turned into a savannah grassland type through human impact (Simmering et al. 2013). Moving their headquarters from Cape Coast to Accra allowed the colonial power to build up the land according to their wishes and needs, including a clear physical separation between European and African areas. Using green spaces as corridors between neighbourhoods, the British thought to be better protected from native-borne diseases (Grant and Yankson 2003). Relocating headquarters also brought an increasing amount of commerce to Accra and it started growing rapidly. In the European areas, building codes were strictly enforced and structures and architecture resembled those found in England at that time (Grant and Yankson 2003), resulting in sparsely populated European and Government areas where trees were planted around bungalows, largely for shade and ornamental purposes (Public Records and Archives Administration Department, ADM 5/1/79, Agricultural Department Report 1922–23). As early as 1896, a tree nursery had been established at the Governor’s Lodge near Accra (Public Records and Archives Administration Department, ADM 5/1/53, Government of the Gold Coast Departmental Reports for the year 1897), a clear indication of how the British valued trees within the city, or more specifically within their residential zones. Planning in African areas, however, was uncommon and unregulated growth created high pressure on the land with housing prioritised over tree planting or protection. These early developments led to a basic city setup with unplanned and unregulated high-density, low-income areas with little or no green on one end of the spectrum and planned and regulated low-density, high-income green areas on the other end.

This is the structure that Nkrumah inherited at Independence in 1957. To facilitate economic growth, he wanted to industrialise the country with Accra at the centre of this



process. His policies attracted a growing amount of industries to the city and people followed, hoping for income opportunities and drawn by services that were lacking in other parts of the country (Adarkwa 2012). While the government had ambitious plans to provide adequate housing, both in terms of quality and quantity, the rate of population growth in Accra was so high that slums and new, unplanned satellite towns on the outskirts of the city would still develop to the detriment of the vegetation cover (Government of Ghana 1964). While the political power had shifted with independence, poorer people and new immigrants to the city still settled in the cheaper, high-density areas while the Ghanaian middle and upper classes, those with political power and connections, took over the spacious and green areas that used to be European (Grant and Yankson 2003).

By the early 1980s, 'the centralization of planning and administration within a socialist ideology had led to acute economic problems throughout Ghana' (Grant and Yankson 2003, p. 69) resulting in the implementation of the structural adjustment programme (SAP) and its neoliberal, 'free-market' policies. While the city of Accra had continuously been expanding over time, increasing by 318% between 1975 and 1997, the majority of this expansion happened in the post-SAP years. This growth took the form of 'encroaching on rural settlements or into green spaces between rural settlements' (Yeboah 2000, p. 70) and it coincided with the period of highest amount of vegetation loss in Accra (Owusu 2018). Increased urbanisation and the conversion of green spaces into residential and commercial land use were, according to Owusu (2018), directly related to the SAP and its predecessor, the economic recovery programme.

Structural adjustment disproportionately affected the more vulnerable groups of society including the urban poor, their number rising from 9 to 23% (Grant and Yankson 2003). Lacking financial means, a sizable proportion of the city's population has been renting accommodation (UN-HABITAT 2011), especially in the densely populated, lower income neighbourhoods in Accra (Yankson 2012). In relation to canopy cover, this is problematic as interviewed tenants expressed low interest in planting and maintaining trees in and around their place of habitation, even if allowed by the respective land owner. Renters often do not expect staying long enough to reap the benefits and if the landlord or landlady lacks interest in greening, the respective compound will likely not feature any trees. If these historical events and processes have, as suggested, a legacy effect, neighbourhoods in Accra should vary with respect to their tree cover. Previously European areas like Cantonments, Ridge (Rain et al. 2011), Kanda, Ringway Estates, or Airport Residential (Quayson 2014) are expected to be sparsely populated with high levels of green while canopy cover should tend to be lower in many of the unplanned areas where Africans had to settle during colonial times.

### Urban Trees in Accra—the Present

The canopy cover of Accra is 14.0% ( $\pm 1.55$ ), plantable space is slightly lower than non-plantable space with 40.4% ( $\pm 2.19$ ) and 45.6% ( $\pm 2.23$ ) respectively. The tree cover of individual neighbourhoods ranges from 0.2% ( $\pm 0.2$ ) in Chorkor to 53.6% ( $\pm 2.23$ ) in Achimota College (Fig. 2). As can be seen in the map, many previously European neighbourhoods continue to feature higher levels of canopy cover. Plantable space is lowest in Ussher Town (10.4%  $\pm 1.74$ ) and other densely populated inner-city neighbourhoods like Chorkor, Mamobi, and Nima which, relatedly, have high amounts



of space that is non-plantable (e.g. Ussher Town with  $87.0\% \pm 1.5$  or Nima with  $78.0\% \pm 1.85$ ). Free space is more readily available in neighbourhoods at the fringe of Accra like East Legon Extension ( $49.8\% \pm 2.24$ ) and La Dadekotopon ( $67.2\% \pm 2.1$ ) or in the less densely populated inner-city neighbourhoods like Dzorwulu ( $41.4 \pm 2.2$ ) and Roman Ridge ( $46.4\% \pm 2.23$ ) (see [Appendix](#)).

In international comparison, Accra's canopy cover of 14% ranges at the lower end with many cities having double its tree cover (e.g. Bloniarz et al. 2014; Foster and Duinker 2017; Seed Consulting Service 2016) although the city of London also

features only 14% (Rogers et al. 2015). These numbers are provided to offer an idea of tree cover in other cities but are not to be taken as a point of reference when formulating objectives for Accra. Actual and potential canopy cover depends on factors like area, climate, original vegetation, and urban density but each city should make their own cost–benefit analysis to determine what tree cover is desirable, attainable and, importantly, sustainable considering the city's context and available resources. As Leff (2016, p. 12) puts it: ‘there is no set canopy cover level that would be considered “optimal” everywhere – or perhaps even in a single location’.

The average crown cover of neighbourhoods within each of the five poverty classes reduces continuously with increasing poverty rating. While non-poverty neighbourhoods have an average cover of 23.1%, this declines to 3.5% in the highest poverty class (Table 4). Examining the relationship between poverty classes and the transformed canopy data, neighbourhoods with lower poverty fall into higher canopy cover classes and those with higher poverty into lower canopy classes significantly more often than would be expected by chance ( $N = 76$ ,  $p < .01$ ). These results are similar to those reported by Stow et al. (2013) who also reported higher vegetation cover for areas of higher socio-economic status (SES) using partially different neighbourhood boundaries, a Housing Quality Index that was created from the 2000 Ghana Census of Population and Housing as a metric for SES, and measured green cover with the Normalised Difference Vegetation Index (NDVI) that includes not only trees but also other types of vegetation like bushes, hedges, or grass areas.

Not all studies that examine the relationship between urban vegetation and socio-economic characteristics find significant correlations (e.g. Talen 1997; Nero 2016), but there is a general tendency for an urban green divide to exist. A spatially uneven urban forest is not an isolated observation, suggesting that similar political, cultural, and economic processes create structures that tend to ‘favor the urban elite at the expense of marginalized individuals and groups’ (Heynen 2003, p. 980). ‘Correcting’ these inequalities, however, is not necessarily a question of simply planting more trees in areas with low canopy as paradoxical effects have been observed where an increase of green space in poorer neighbourhoods has led to the exclusion of inhabitants as the newly upgraded areas became attractive for richer people (Wolch et al. 2014). Additionally, Heynen (2003) raises the question of the connection between justice and scale. Planting trees in deprived neighbourhoods could increase justice at the local level as more individuals, and especially those that are disadvantaged by the current structure, could benefit from shaded areas, fruits, or reduced run-offs. The resulting patchy nature of the urban forest might, however, not be ideal for providing services considered to be of value at the global scale for which larger, connected tree areas would be optimal. There are, therefore, trade-offs to be made between the local and the global when deciding where to plant

**Table 4** Average canopy cover in different poverty classes

Poverty class	Non	Low	Moderate	High	Very high
Average canopy cover	23.1%	13.8%	12.4%	8.1%	3.5%

trees (Heynen 2003). In Accra, current spatial disparity is so pronounced that some neighbourhoods are largely devoid of trees and a singular focus on the global scale would forgo using their services and benefits to ameliorate urban living conditions for a significant amount of individuals. While increasing canopy cover in lower income areas to match the numbers found in many of the more affluent residential zones might not be a feasible objective, decreasing the locally existing green divide should be.

## Conclusion

Current canopy cover varies significantly between richer and poorer neighbourhoods in Accra, resulting in uneven access opportunities to trees and their benefits. These ecosystem goods and services can help compensate problems associated with urban population growth and climate change, thereby improving upon people's well-being. While urban trees do have costs, outputs can be optimised by selecting appropriate trees for designated planting spaces and implementing adequate maintenance schemes. Some trade-offs, in terms of who can benefit how and to what extent, are unavoidable due to the complex interplay of services and disservices at various scales. While there is debate as to the appropriateness of 'correcting' green disparities at the local level, possibly at the expense of global benefits, I argue that the significant intra-city differences in Accra cannot be ignored completely and future tree planting should try to decrease the existing gap.

Understanding the origins of the green divide is a crucial step in reducing the likelihood of an unjust future urban forest. This paper discussed some of the historic events and processes that have influenced the city's development and, directly or indirectly, impacted upon tree cover. Areas that used to be exclusively European in colonial times were well-planned and tree planting was an integral part of their design while African areas suffered from unplanned growth and high population density. The research has shown that this basic structure has been preserved over time and continues to be visible in current day Accra where historical tree planting patterns have left a lasting imprint. History, however, does not just help explain the present but can, and should be used to analyse how the current urban forest might develop in relation to contemporary political, economic, and social events and processes. Assessing these potential effects requires not just a deep understanding of the past but a substantial amount of foresight. While not a precise prediction, the 'effects of past management systems can provide an indication of how current ecosystems may react to management efforts' (Szabó 2010, p. 383), applying our understanding of the past to enhance future outcomes.

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## Appendix

Area	Canopy cover % (± SE)	Non-tree plantable % (± SE)	Non-tree non-plantable % (± SE)	Overall poverty rating
Accra	14.00 (± 1.55)	40.40 (± 2.19)	45.60 (± 2.23)	/
Abeka	05.00 (± 0.97)	24.20 (± 1.92)	70.80 (± 2.03)	4
Abelenkpe	13.40 (± 1.52)	36.80 (± 2.16)	49.80 (± 2.24)	1
Abofu	16.60 (± 1.66)	34.00 (± 2.12)	49.40 (± 2.24)	4
Abossey Okai	03.80 (± 0.86)	22.20 (± 1.86)	74.00 (± 1.96)	4
Accra Central	06.60 (± 1.11)	31.40 (± 2.08)	62.00 (± 2.17)	3
Achimota College	53.60 (± 2.23)	32.60 (± 2.10)	13.80 (± 1.54)	2
Adabraka	09.20 (± 1.29)	32.60 (± 2.10)	58.20 (± 2.21)	3
Airport Res.	30.40 (± 2.06)	36.00 (± 2.15)	33.60 (± 2.11)	1
Airport West Res.	22.40 (± 1.86)	39.40 (± 2.19)	38.20 (± 2.17)	3
Akweteyman	11.80 (± 1.44)	31.60 (± 2.08)	56.60 (± 2.22)	4
Alajo	06.20 (± 1.08)	33.40 (± 2.11)	60.40 (± 2.19)	3
Alogboshie	07.80 (± 1.20)	44.60 (± 2.22)	47.60 (± 2.23)	3
Asylum Down	12.60 (± 1.48)	24.40 (± 1.92)	63.00 (± 2.16)	2
Avenor	03.60 (± 0.83)	34.80 (± 2.13)	61.60 (± 2.18)	3
Awudome	26.20 (± 1.97)	37.00 (± 2.16)	36.80 (± 2.16)	3
Bubuashie	12.60 (± 1.48)	36.60 (± 2.15)	50.80 (± 2.24)	3
Cantonments	27.60 (± 2.00)	38.80 (± 2.18)	33.60 (± 2.11)	3
Chorkor	00.20 (± 0.20)	18.60 (± 1.74)	81.20 (± 1.75)	4
Dansoman	17.00 (± 1.68)	29.80 (± 2.05)	53.20 (± 2.23)	2
Darkuman	07.40 (± 1.17)	26.60 (± 1.98)	66.00 (± 2.12)	3
Dzorwulu	15.00 (± 1.60)	41.40 (± 2.20)	43.60 (± 2.22)	1
East Legon	14.40 (± 1.57)	40.80 (± 2.20)	44.80 (± 2.22)	2
East Legon Ext.	20.00 (± 1.79)	49.80 (± 2.24)	30.20 (± 2.05)	3
Gbegbeyise	02.00 (± 0.68)	29.20 (± 2.03)	68.80 (± 2.07)	4
James Town	01.20 (± 0.49)	41.20 (± 2.20)	37.60 (± 2.21)	3
Kanda	21.40 (± 1.83)	41.40 (± 2.20)	37.20 (± 2.16)	4
Kaneshie	05.00 (± 0.97)	33.20 (± 2.11)	61.80 (± 2.17)	3
Kisseman	16.20 (± 1.65)	37.20 (± 2.16)	46.60 (± 2.23)	3
Kokomlemle	03.80 (± 0.86)	27.80 (± 2.00)	68.40 (± 2.08)	2
Korle Bu	22.40 (± 1.86)	53.60 (± 2.23)	24.00 (± 1.91)	3
Korle Dudor	02.80 (± 0.74)	26.00 (± 1.96)	71.20 (± 2.03)	4
Korle Gonno	05.20 (± 0.99)	37.00 (± 2.16)	57.80 (± 2.21)	3
Kotobabi	04.00 (± 0.88)	31.00 (± 2.07)	65.00 (± 2.13)	4
Kpehe	04.00 (± 0.88)	30.80 (± 2.06)	65.20 (± 2.13)	4
Kwashiman	05.60 (± 1.03)	35.20 (± 2.14)	59.20 (± 2.20)	4
La	08.80 (± 1.27)	31.60 (± 2.08)	59.60 (± 2.19)	3
La Dadekotopon	10.40 (± 1.37)	67.20 (± 2.10)	22.40 (± 1.86)	3

Area	Canopy cover % ( $\pm$ SE)	Non-tree plantable % ( $\pm$ SE)	Non-tree non-plantable % ( $\pm$ SE)	Overall poverty rating
Labone	19.40 ( $\pm$ 1.77)	39.60 ( $\pm$ 2.19)	41.00 ( $\pm$ 2.20)	2
Lapaz	05.80 ( $\pm$ 1.05)	35.00 ( $\pm$ 2.13)	59.20 ( $\pm$ 2.20)	4
Lartebiokorshie	13.00 ( $\pm$ 1.50)	33.20 ( $\pm$ 2.11)	53.80 ( $\pm$ 2.23)	2
Lagon	33.60 ( $\pm$ 2.11)	50.80 ( $\pm$ 2.24)	15.60 ( $\pm$ 1.62)	3
Mamobi	04.40 ( $\pm$ 0.92)	18.60 ( $\pm$ 1.74)	77.00 ( $\pm$ 1.88)	4
Mamponse	05.40 ( $\pm$ 1.01)	32.20 ( $\pm$ 2.09)	62.40 ( $\pm$ 2.17)	4
Mamprobi	08.60 ( $\pm$ 1.25)	30.40 ( $\pm$ 2.06)	61.00 ( $\pm$ 2.18)	4
Mateheko	07.60 ( $\pm$ 1.19)	28.80 ( $\pm$ 2.03)	63.60 ( $\pm$ 2.15)	2
Ministerial Area	15.20 ( $\pm$ 1.61)	49.00 ( $\pm$ 2.24)	35.80 ( $\pm$ 2.14)	3
Mpoase	03.40 ( $\pm$ 0.81)	33.80 ( $\pm$ 2.12)	62.80 ( $\pm$ 2.16)	3
New Fadama	08.40 ( $\pm$ 1.24)	33.80 ( $\pm$ 2.12)	57.80 ( $\pm$ 2.21)	3
New Town	03.60 ( $\pm$ 0.83)	31.40 ( $\pm$ 2.08)	65.00 ( $\pm$ 2.13)	4
Nima	04.40 ( $\pm$ 0.92)	17.60 ( $\pm$ 1.70)	78.00 ( $\pm$ 1.85)	5
North Alajo	05.80 ( $\pm$ 1.05)	38.40 ( $\pm$ 2.18)	55.80 ( $\pm$ 2.22)	4
North Dzorwulu	21.00 ( $\pm$ 1.82)	40.80 ( $\pm$ 2.20)	38.20 ( $\pm$ 2.17)	1
North Industrial	07.80 ( $\pm$ 1.20)	31.60 ( $\pm$ 2.08)	60.60 ( $\pm$ 2.19)	2
North Kaneshie	15.60 ( $\pm$ 1.62)	35.20 ( $\pm$ 2.14)	49.20 ( $\pm$ 2.24)	2
North Odorkor	12.40 ( $\pm$ 1.47)	37.60 ( $\pm$ 2.17)	50.00 ( $\pm$ 2.24)	4
North Ridge	28.40 ( $\pm$ 2.02)	35.40 ( $\pm$ 2.14)	36.20 ( $\pm$ 2.15)	1
Nyaniba Estate	12.60 ( $\pm$ 1.48)	32.00 ( $\pm$ 2.09)	55.40 ( $\pm$ 2.22)	4
Old Mamprobi	10.60 ( $\pm$ 1.38)	34.20 ( $\pm$ 2.12)	55.20 ( $\pm$ 2.22)	4
Old Tesano	11.00 ( $\pm$ 1.40)	36.40 ( $\pm$ 2.15)	52.60 ( $\pm$ 2.23)	2
Osu	10.20 ( $\pm$ 1.35)	36.80 ( $\pm$ 2.16)	53.00 ( $\pm$ 2.23)	4
Ringway Estate	30.20 ( $\pm$ 2.05)	33.20 ( $\pm$ 2.11)	36.60 ( $\pm$ 2.15)	2
Roman Ridge	24.80 ( $\pm$ 1.93)	46.40 ( $\pm$ 2.23)	28.80 ( $\pm$ 2.03)	1
Russia	06.00 ( $\pm$ 1.06)	28.40 ( $\pm$ 2.02)	65.60 ( $\pm$ 2.12)	4
Sabon Zongo	05.20 ( $\pm$ 0.99)	28.00 ( $\pm$ 2.01)	66.80 ( $\pm$ 2.11)	4
Sempe	09.80 ( $\pm$ 1.33)	29.00 ( $\pm$ 2.03)	61.20 ( $\pm$ 2.18)	4
South Industrial	05.60 ( $\pm$ 1.03)	36.40 ( $\pm$ 2.15)	58.00 ( $\pm$ 2.21)	2
South Labadi	06.20 ( $\pm$ 1.08)	51.80 ( $\pm$ 2.23)	42.00 ( $\pm$ 2.21)	4
South Legon	22.00 ( $\pm$ 1.85)	57.60 ( $\pm$ 2.21)	20.40 ( $\pm$ 1.80)	3
South Odorkor	10.80 ( $\pm$ 1.39)	39.20 ( $\pm$ 2.18)	50.00 ( $\pm$ 2.24)	4
Sukura	08.60 ( $\pm$ 1.25)	37.80 ( $\pm$ 2.17)	53.60 ( $\pm$ 2.23)	4
Tesano	21.80 ( $\pm$ 1.85)	44.60 ( $\pm$ 2.22)	33.60 ( $\pm$ 2.11)	2
Tudu	06.00 ( $\pm$ 1.06)	31.80 ( $\pm$ 2.08)	62.20 ( $\pm$ 2.17)	3
Ussher Town	02.60 ( $\pm$ 0.71)	10.40 ( $\pm$ 1.37)	87.00 ( $\pm$ 1.50)	5
W. Abossey Okai	09.40 ( $\pm$ 1.31)	37.60 ( $\pm$ 2.17)	53.00 ( $\pm$ 2.23)	4
West Ridge	28.60 ( $\pm$ 2.02)	40.20 ( $\pm$ 2.19)	31.20 ( $\pm$ 2.07)	1
Zoti	17.40 ( $\pm$ 1.70)	43.40 ( $\pm$ 2.22)	39.20 ( $\pm$ 2.18)	4

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